# CHAPTER 2
# Project Description

## 2.1 Overview

DWR proposes to implement the Lake Perris Dam Remediation Program to remediate the Lake Perris Dam, replace the outlet tower, and construct an outlet conveyance to connect with the Perris Valley Storm Drain. The project is being proposed to address seismic safety concerns and to bring the facilities up to current safety standards. This section provides some background on DWR and Lake Perris, identifies project objectives, and presents the proposed project description.

## 2.2 Project Background

### 2.2.1 State Water Project

DWR operates and maintains the State Water Project (SWP), supplying water to 29 contracting agencies across the state. DWR operates 33 storage facilities, 20 pumping plants, four pumping-generating plants, five hydroelectric power plants, and 660 miles of canals and pipelines within the SWP (DWR, 2007a). Lake Perris is the terminal reservoir for the East Branch of the California Aqueduct, providing a key water supply to Southern California State Water Contractors including the Metropolitan Water District of Southern California (MWD or Metropolitan), which provides potable water to 28 cities and water districts within Southern California.

The California Aqueduct conveys water to Southern California from the Sacramento-San Joaquin Delta. The Delta receives runoff from over forty percent of California's land including flows from the Sacramento and San Joaquin Valleys. Water travels south from the Delta to the 444 mile-long California Aqueduct. The Aqueduct then splits into the West and East Branches south of the Tehachapi Mountains. The East Branch extends through Lake Silverwood, continues on through the Santa Ana Pipeline, and then terminates at Lake Perris. **Figure 2-1** depicts the California Aqueduct extending southward from the Sacramento River Delta.

The amount of water available to the SWP fluctuates widely each year due to factors such as hydrologic conditions, flood management needs, the capacity of SWP storage and conveyance facilities, changing weather-temperature conditions, water quality, and environmental requirements. Water deliveries are based on the long-term contracts that DWR has with each of the 29 contractors. Though the proposed project would require Lake Perris to be refilled, the


SOURCE: DWR, 2007.

DWR - Perris Dam Remediation Program . 206008.02

**Figure 2-1**
State Water Project Overview

project would not cause additional water to be taken from the Delta. The lake would only be refilled when water is available, which is dependent on the factors described above.

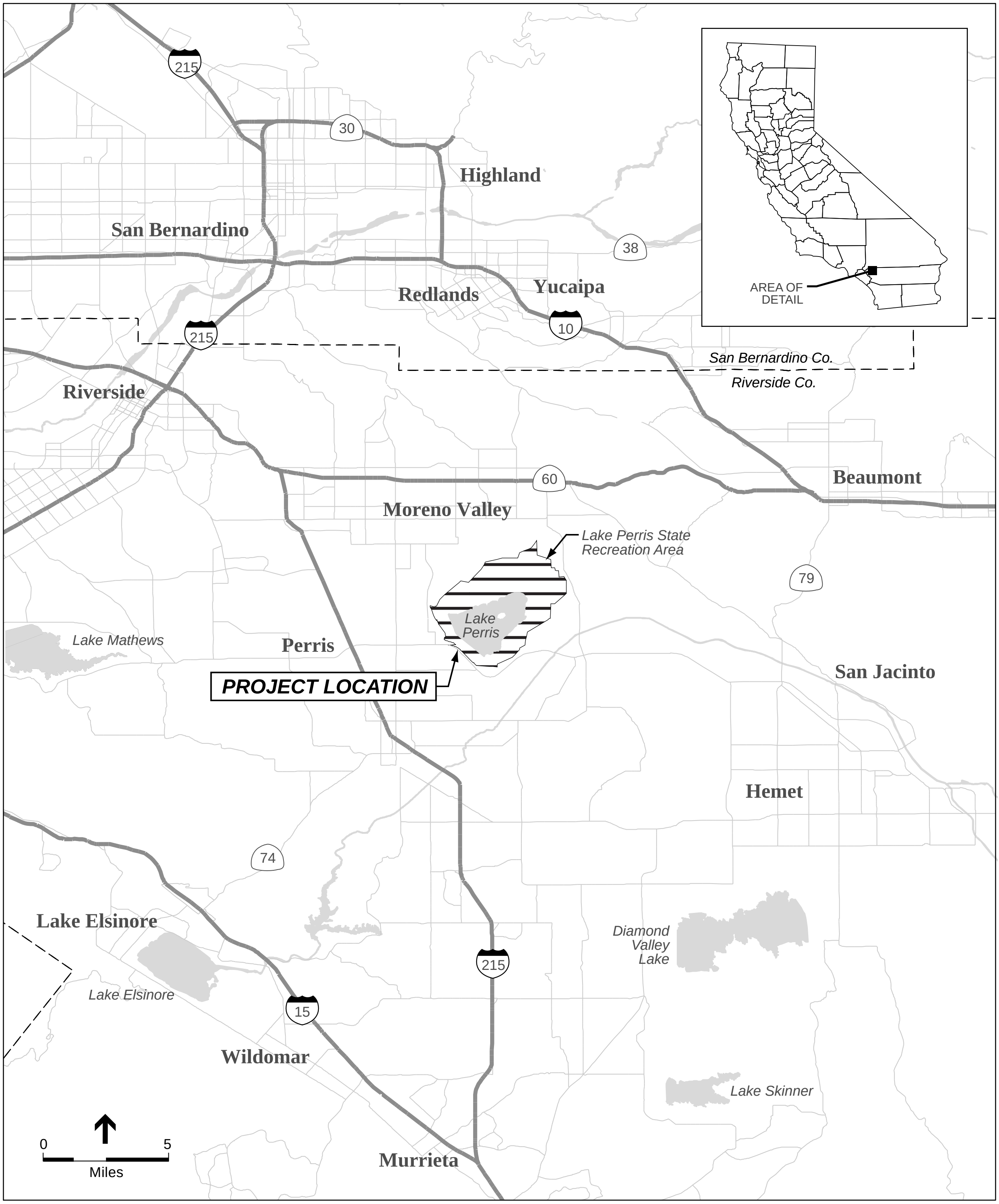
Recent developments regarding the Delta have introduced uncertainty into the SWP's ability to convey water to the contractors. In 2004, the Bureau of Reclamation and DWR developed a new Operating Criteria and Plan (OCAP) for the SWP and the Central Valley Project (CVP). The OCAP included the project descriptions required for a comprehensive biological assessment of the effects of SWP and CVP operations on listed species. In 2004, USFWS issued a non-jeopardy biological opinion (BO) with regards to impacts to the Delta smelt caused by revised operations of the CVP and SWP. The BO concluded that adverse effects to the Delta smelt would be avoided or minimized by the conservation and adaptive management measures included in the OCAP. In May 2007, the Wanger decision made by the U.S. District Court found the OCAP BO for Delta smelt to be inconsistent with the Federal Endangered Species Act and required that it be rewritten. On December 14, 2007 the court established interim operating rules while the BO is being rewritten that include in-Delta flow limits in Old and Middle Rivers which have the effect of restricting SWP and CVP pumping (DWR, 2007b).

Since the Wanger decision, a new BO has been issued by the USFWS for Delta Smelt. DWR preliminary modeling analysis conducted in December 2008 indicated that the measures within the new BO are significantly more restrictive than the Wanger Decision and would consequently further reduce exports from the Delta (i.e. further decrease reliability of the SWP). In addition, the California Department of Fish and Game Commission has since issued an Incidental Take Permit for longfin smelt that contains operational actions and the National Marine Fisheries Service has issued a new BO for Salmon that contains additional export limitations. Both of these permits could further reduce SWP reliability.

Preliminary modeling from DWR addressing the affects of the recently released Delta Smelt BO does indicate that additional significant reductions to SWP reliability are possible. Modeling results from DWR that take into account all recent actions that will further restrict the ability to export from the Delta and consequently reduce SWP reliability will not be available until the 2009 State Water Project Delivery Reliability Report is available, currently anticipated in the fall of 2009. This report may conclude that SWP reliability may decrease even further. The Perris Dam Remediation Program would not affect, or be affected by SWP reliability.

## 2.2.2 Perris Dam and Reservoir

Perris Dam and Reservoir, a multi-purpose facility known collectively as Lake Perris, is located within the Lake Perris State Recreation Area (SRA). **Figure 2-2** shows the regional location of the Lake Perris SRA. Perris Dam is an earthfill embankment completed in 1972, containing approximately 25 million cubic yards of compacted fill. The embankment is approximately 11,600 feet long, with a maximum structural height of 128 feet. The fill material was originally obtained from sediments in what was to become the lake bed, from clay borrow northeast of the lake, and from a quarry constructed within the Bernasconi Hills just east of the dam within the Lake Perris SRA.




SOURCE: Riverside County, 2007.



**Figure 2-2**
Regional Location Map

While DWR may vary the water surface elevation to provide for operational requirements, the normal maximum operating water level on the lake is 1588 feet above mean sea level (amsl), 108 feet above reservoir bottom. The spillway crest is 1590 feet amsl and the dam crest elevation is at 1600 feet amsl. The designed reservoir capacity is 131,000 acre-feet (af) with a surface area of 2,320 acres.

Though primarily a water supply reservoir, recreational and fish and wildlife enhancement opportunities consistent with the water supply uses were considered during original construction and extended to the California Department of Parks and Recreation (DPR) and the California Department of Fish and Game (CDFG). The lake provides water supply, recreation, sport fishery, wildlife enhancement, emergency water storage uses, and incidental flood protection. Recreation opportunities include fishing, hunting, boating, picnicking, camping, nature study, rock climbing, horse back riding, and hiking.

Resources Agency Order No. 6, dated March 13, 1963, defines the responsibilities of each department at SWP multi-purpose facilities pursuant to Water Code Sections 11900-11925, also known as the Davis-Dolwig Act. The water storage and conveyance facilities and acquired land are owned and operated by DWR in cooperation with MWD of Southern California, Coachella Valley Water District, and Desert Water Agency. DPR and CDFG, whose use is subordinate to the water supply project purpose, are responsible for the management, operation, and maintenance of the public recreation areas.

## 2.2.3 Need for the Project

### Perris Dam Remediation

The seismic stability of Perris Dam has been evaluated since its design in the 1960s and construction in the 1970s. Results of the earlier studies indicated that the strain potential on the dam during intense ground shaking caused by seismic events was relatively low. The initial foundation studies were considered adequate by the standards of practice during the design phase in the late-1960s and early-1970s. However significant advances in soil liquefaction engineering including soil sampling and testing methods have resulted in a different interpretation of the foundation conditions and predicted performance.

In 2005, DWR completed a foundation study of the Perris Dam. Results of the detailed liquefaction analysis of the Perris Dam foundation indicated that seismically-induced ground shaking could result in embankment deformations due to the liquefaction potential of sediments under the dam at several locations along the 2300-foot-long segment along the southern span (left reach) of the dam. With the lake filled to its design capacity, this could result in overtopping of the dam during a strong ground shaking event. Based on the results of this stability analysis, DWR lowered the reservoir water surface elevation by 25 feet to 1563 feet amsl, until a long-term remedial solution can be implemented. This reduction in surface elevation reduced the storage capacity of the lake by approximately 40 percent from 126,841 af to 72,000 af.

The foundation study also concluded that the presence of loose sands beneath the dam embankment at the right abutment should be further investigated. Subsequent investigation by DWR concluded that excavation and replacement of a small portion of the dam is warranted. This work extends as deep as Elevation 1574 (11 feet above the maximum lake level during the drawdown period). It is anticipated that approximately 15,000 cubic yards (cy) of dam material and underlying loose silty sand would be excavated and recompacted. The excavated clay core and silty sand shells of the dam would be reused, and a relatively small amount of imported clay (up to 4000 cy) would be needed to rebuild this portion of the dam.

A Perris Dam Reconnaissance Study was conducted in 2006 to evaluate alternatives to the dam remediation. Alternatives evaluated in the Reconnaissance Study included permanently lowering the lake level, maintaining the existing level, and raising the normal maximum operating level of the reservoir. The report recommended that restoring the lake to historical operating levels had the least impact.

Remediation of the dam foundation would encounter some below-grade drainage structures and monitoring wells that either would have to be destroyed or replaced. This includes some of the relief wells and other portions of the seepage collection system. The relief wells along the left reach would be destroyed by overdrilling and backfilling with cement-bentonite grout. They would be replaced by new relief wells. The perforated pipes in the toe drain of the dam and in the drain line connecting the relief wells are likely made of asbestos cement pipe. These drainage elements would be removed as part of the excavation at the toe of the dam. The new toe drain (12-inch perforated PVC or HDPE pipe) would be placed at the toe of the new berm to replace the toe drain (12-inch perforated asbestos-containing pipe) excavated from the toe of the dam. The length of the toe drain pipe would be up to 5200 feet. Similarly, up to 4000 feet of 12-inch perforated ACP would be removed from the line of relief wells and replaced with perforated PVC or HDPE as part of the new relief wells. The 1500 feet of existing 24-inch solid ACP that drains seepage water from the toe drain and relief wells to the flow meter near Ramona Expressway would also be replaced as it interferes with construction of both the dam foundation remediation and the emergency outlet conveyance construction. Finally, shallow irrigation lines may exist in the project area that were abandoned prior to construction of the dam. These abandoned water delivery pipes would be removed where encountered and capped if necessary.

## Outlet Tower Replacement

The existing outlet tower, built in the early 1970s, is a 105-foot tall, freestanding structure constructed in the lake near the left abutment of the dam. The outlet tower contains 10 hydraulically operated 72-inch butterfly valves located at each of five equally spaced levels between Elevation 1503 and 1567 with two valves at each location. The tower was constructed of reinforced concrete and is circular in cross section with an inside diameter of 26 feet and an outside diameter of 31 feet. The outlet tower releases water from five selected levels to a 150-inch (12.5 foot) diameter horizontal tunnel at its base. The function of the outlet facility is to convey water to MWD’s delivery facility just southwest of the eastern abutment of the dam and to have the ability to release water from the lake when required during emergencies for the safety of the dam.

The structural integrity of the tower was evaluated in 2006 and was found to be deficient in shear capacity under pre-2008 seismic loading which could cause a failure of the structure. To remediate the stability of the outlet tower, DWR evaluated options to either retrofit the existing outlet tower or construct a new facility on the shore near the current tower. Several potential alternatives were considered to retrofit the tower, but none were found to be viable to reinforce the structure, given complexities of construction with water in the reservoir, thus construction of a new tower is required.

### Emergency Outlet Extension

When Perris Dam was initially constructed, there was little development between the dam and the Perris Valley Storm Drain. The dam's emergency release facilities were designed and constructed to release 3800 cubic feet per second (cfs) of water downstream of the dam, allowing the water to form its own overland channel, resulting in an inundation area of 2700 acres. Over time, the areas downstream of the dam were developed with residential land uses that could be affected should the emergency release be needed. The existing emergency outlet structure consists of a rectangular pipe (12 feet by 6 feet), slide gate, and bulkhead, capable of releasing a maximum of 3800 cfs. The new facility would be sized to accommodate up to 1500 cfs which is the current emergency drawdown capacity requirement set by the California Department of Safety of Dams for Lake Perris. Currently, water released from the dam in an emergency could flood downstream residents because there is no conveyance structure to contain or direct the emergency flows.

## 2.2.4 Project Objectives

The objectives of the proposed project are to:

- Upgrade SWP infrastructure to meet current seismic standards
- Maintain SWP delivery commitments
- Maintain maximum access to beneficial uses at Lake Perris SRA during period of drawdown while ensuring public safety during construction
- Maintain maximum amount of pre-drawdown riparian habitat at Lake Perris SRA during period of drawdown
- Minimize risks associated with seismic hazards
- Provide infrastructure for the implementation of a safe emergency drawdown
- Enhance and restore public safety
- Maximize beneficial use of Lake Perris SRA by restoring reservoir to pre-drawdown water levels
- Minimize environmental impacts

## 2.3 Project Location

Lake Perris is located between the cities of Moreno Valley and Perris in an unincorporated area of Riverside County, approximately 15 miles south of the City of Riverside and 65 miles east of the City of Los Angeles (see Figure 2-2).

## 2.4 Baseline Condition

CEQA states that a project's potential impacts should be assessed against the existing baseline condition at the time the NOP is published (§15125). However, for purposes of this project, the baseline condition is assumed to be the pre-drawdown condition that was present in spring of 2005, before DWR implemented the 25 foot water level drawdown in the reservoir. The drawdown was conducted as an emergency public safety action and was identified as such in a CEQA Categorical Exemption filed by DWR in August 2005. For purposes of this EIR, the drawdown of the lake from an elevation of 1588 feet amsl to the current elevation of 1563 feet amsl, and subsequent improvements implemented by DWR to the facilities at the Lake Perris SRA are considered to be part of the project description.

## 2.5 Project Description

In addition to the drawdown itself, the proposed Perris Dam Remediation Program includes three separate components as described below: (1) Perris Dam Remediation, (2) Outlet Tower Replacement, and (3) Emergency Outlet Extension. The three components combined provide the upgraded seismic protection needed to protect public safety. **Figure 2-3** shows the location of each of the proposed components. The following sections describe each component.

### 2.5.1 Lake Perris Drawdown

On August 2005, DWR initiated the drawdown of Lake Perris from 1588 feet amsl to 1563 feet amsl. The drawdown was complete by November 2005. The water removed from the lake was delivered to MWD for delivery or storage in other facilities. **Figure 2-4** shows the area of the lakebed exposed during this process. DWR conducted several actions to mitigate initial impacts of the drawdown. In an effort to maintain recreational activities on the lake, DWR ensured that the marina remained in the lowered lake and constructed a causeway from the shore across the exposed lakebed, providing full access to the marina facility. In addition, the Department of Boating and Waterways physically moved docks 60 feet further off-shore to improve vessel access to slips. New ADA[1]-compliant access ramps were restored to these docks by DWR to replace those which had become too steep due to the drawdown. DWR also imported 14,171 tons of sand to the Perris Beach area to enhance beach-going recreational uses near the location of the previous beaches. DWR also installed a 2-mile long irrigation system connected to State Park water pumps and drip-line system that conveys lake water to the riparian habitat that exists along the eastern edge of the original lakeshore. Figure 2-4 shows the location of the new beach, marina causeway, boat launch extensions, and irrigation system.

[1] American's with Disabilities Act (ADA)


SOURCE: GlobeXplorer, 2007; DWR, 2007; ESA, 2009.

DWR - Perris Dam Remediation Program . 206008.02

**Figure 2-3**
Location of Proposed Project Elements


SOURCE: GlobeXplorer, 2007; DWR, 2007; ESA, 2007.

DWR - Perris Dam Remediation Program . 206008.02

**Figure 2-4**
Post-Drawdown Improvements

## 2.5.2 Perris Dam Remediation

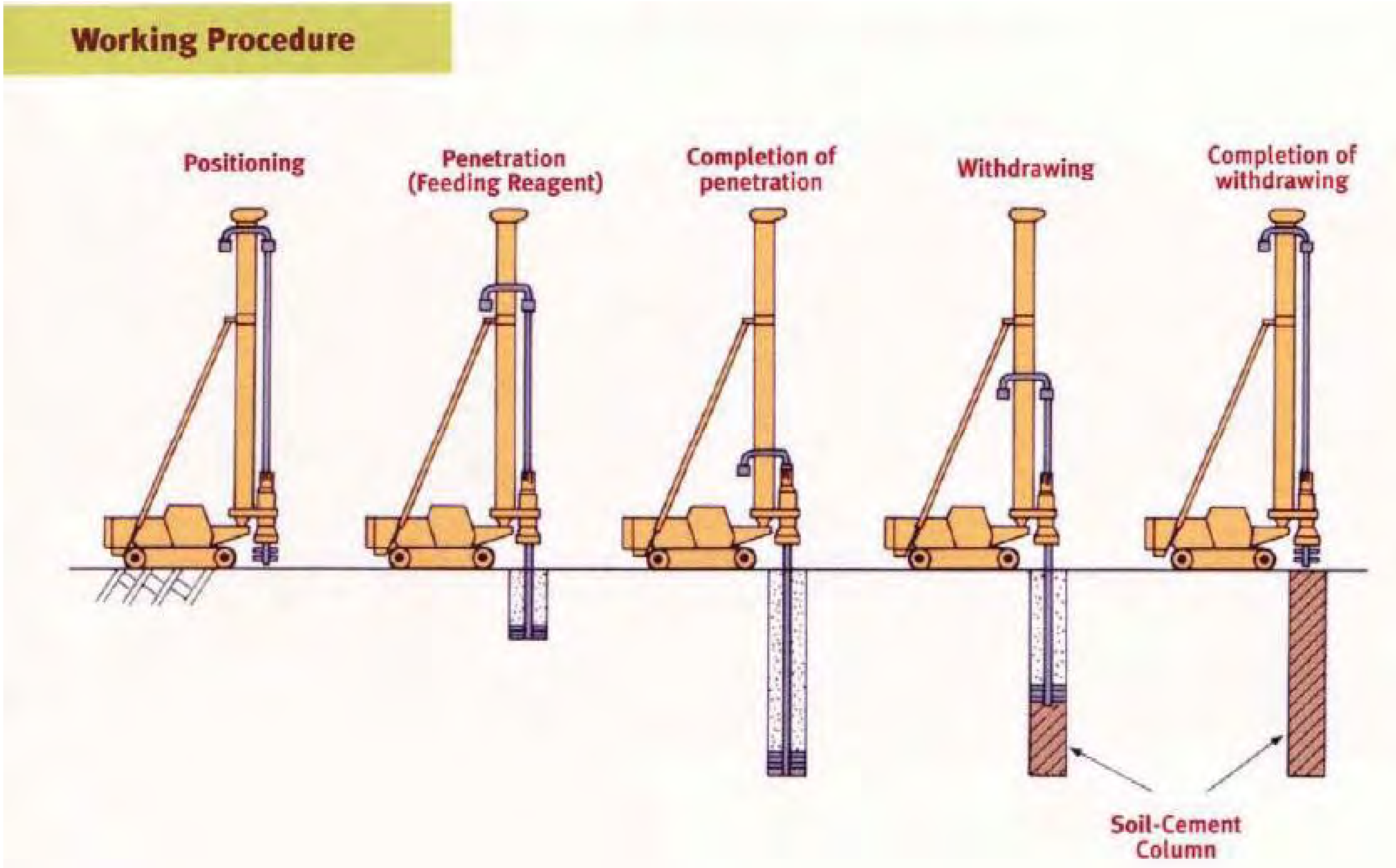
DWR proposes to seismically upgrade the dam by improving the foundation material with cement-deep-soil-mixing (CDSM) methods, excavating the toe of the dam to remove the liquefiable berm foundation material, replacing the berm foundation material with re-compacted engineered fill, and then constructing a stability berm on top of the replaced berm foundation. This remediation strategy would allow Lake Perris to return to its previous maximum operating pool elevation of 1588 feet amsl after construction.

CDSM methods involve thoroughly mixing cement paste with in-situ native soils within a zone from approximately 60 feet below original grade at the downstream toe of the dam. The blocks of soil-cement columns would be installed in the deepest and most liquefiable alluvial materials beneath the berm foundation. Deep soil mixing increases the stability of the soil and reduces liquefaction hazards as well as temporary destabilization caused by excavations at the toe. **Figure 2-5** presents a schematic view of CDSM techniques.

Following deep soil mixing, the groundwater would be lowered by an array of pumping wells and either temporary sheet piles or a permanent CDSM wall to facilitate the excavation and replacement of the uppermost liquefiable soils. The current seepage collection system is fed by gravity and is comprised of a drainage blanket, toe drain collector pipe, relief wells, relief well collector pipe, one large diameter well and a main drain line that leads to the flow meter. The new seepage collection system would serve essentially the same purpose. New relief wells and collector piping would be installed to prevent ponding of seepage water on the ground surface once the lake level is returned to its original elevation. The wells and the extended drainage blanket would maintain a stable groundwater elevation south of the dam. The water pumped from the wells during construction would discharge into a solid pipe leading out to the flow meter and on toward MWD’s delivery system. After construction, gravity drainage from the extended drainage blanket and the new wells would also flow through the existing flow meter on toward MWD’s system.

Approximately 700,000 cy of soil would be excavated from the shallow berm foundation at the toe of the dam. **Figure 2-6** provides a cross-section of the proposed excavation. Drain rock would be placed in the bottom lifts of the excavation to extend the existing drainage blanket to the new toe of the stability berm. The excavated material would be stockpiled on site and recompacted as excavation backfill and as part of the stability berm. Approximately 800,000 tons of drain rock and 300,000 cy of soil would be backfilled into the excavation area.

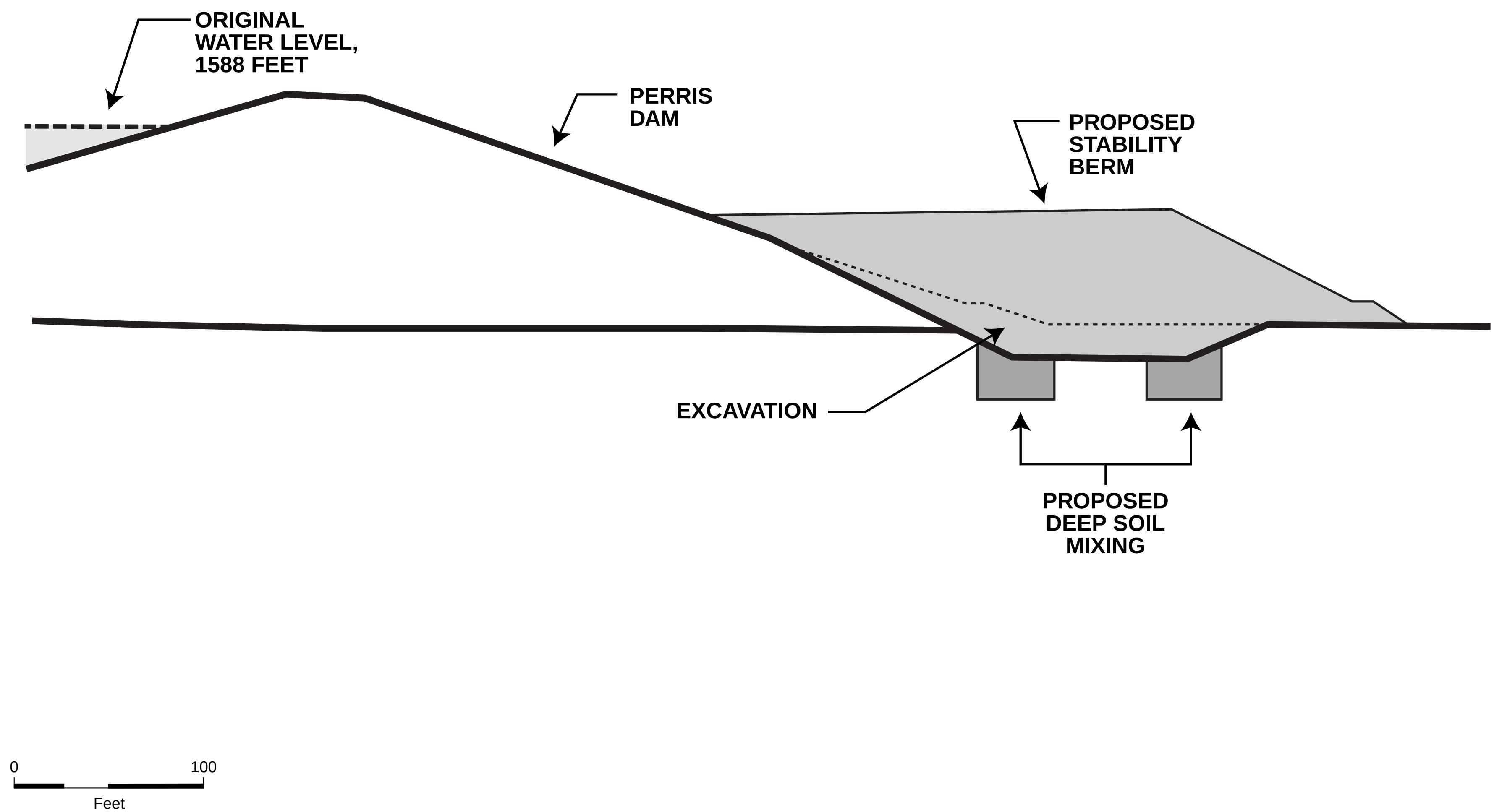
A stability berm would be constructed atop the re-compacted berm foundation along the downstream toe of the dam as shown schematically in **Figure 2-7**. The berm would consist of approximately 1.75 million cubic yards of soil and one million tons of rock. As shown in Figure 2-3, the soil for the stability berm would be excavated from within the lakebed at the east end of the lake, and the rock would be quarried from the original rock quarry east of the lake in Bernasconi Hills. To convey the soil and rock to the downstream face of the dam, a haul road would be constructed from the east side of the lake, along the lakebed on the south side of the




SOURCE: Courtesy of Raito, Inc.



**Figure 2-5**
Cement Deep Soil Mixing




SOURCE: Department of Water Resources, 2007.



**Figure 2-6**
Perris Dam
Cross Section


Dam Remediation and Emergency Outlet Extension

0 900
Feet

SOURCE: GlobeXplorer, 2008; DWR, 2009; ESA, 2009.

DWR - Perris Dam Remediation Program . 206008.02

**Figure 2-7**
Emergency Outlet Extension

lake, and over a low spot on the Bernasconi Hills near the dam's left abutment. Figure 2-3 and **Figure 2-8** show the proposed route for the haul road.

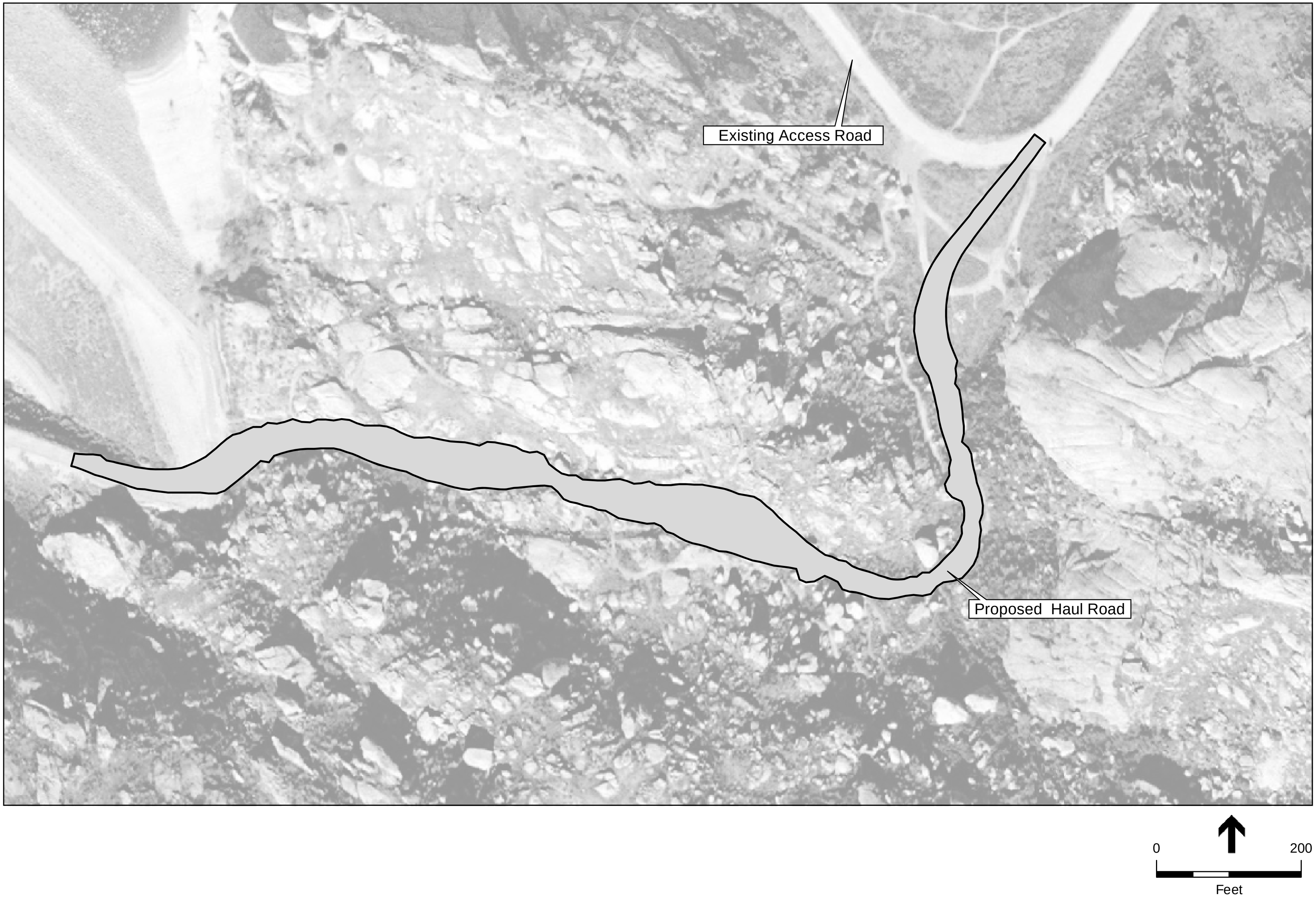
Soil and rock hauled to the toe of the dam may be stockpiled near the construction area or applied directly to the construction activity as they are quarried and delivered. **Figure 2-9** shows the construction zone including staging areas.

The borrow area would be located entirely within the lakebed exposed by the temporary drawdown. Similarly, the haul road would be constructed entirely within the exposed lakebed from the borrow area to just south of the dam. As shown in Figure 2-8, the haul road would continue over a portion of the Bernasconi Hills to the downstream side of the dam. The haul road in this location would require blasting and become a permanent, paved maintenance road at the end of construction. The borrow area and remaining portions of the haul road would be submerged when the lake is refilled.

### 2.5.3 Outlet Tower Replacement

DWR is proposing to construct a new outlet structure as a replacement facility, because the existing tower may fail during a major earthquake. The new outlet facility would be located approximately 400 feet from the existing tower. An area on the southern shore between the hill and the lake would be excavated and the new outlet tower constructed using dry construction methods (**Figure 2-10**). Excavated material would be hauled to the dam remediation construction area and used in the stability berm. Blasting into hard rock would be required.

The new facility would consist of a tower extending from the dead pool elevation of 1500 feet of the lake to an elevation of 1600 feet amsl, approximately 12 feet above the lake level when full. Appurtenant structures on top of the tower would extend an additional 20 feet above ground level. The facility would be constructed within the excavation. A 600-foot long, 12.5-foot diameter tunnel would be constructed to connect the new outlet facility to the existing underground tunnel that connects to MWD's delivery system. A staging area would be needed near the construction area, as shown on Figure 2-10, to stockpile construction material and equipment. Once the new outlet structure and the tunnel are constructed, a 300-foot long approach channel would be constructed to open the new outlet to the lake. A buoy line would be set in the lake approximately 300 feet from the shore limiting access to the vicinity of the facility. The old outlet tower would remain in place and would not be deconstructed.




SOURCE: DWR, 2009; ESA, 2009.

DWR - Perris Dam Remediation Program . 206008.02

**Figure 2-8**
Haul Road over Bernasconi Hills

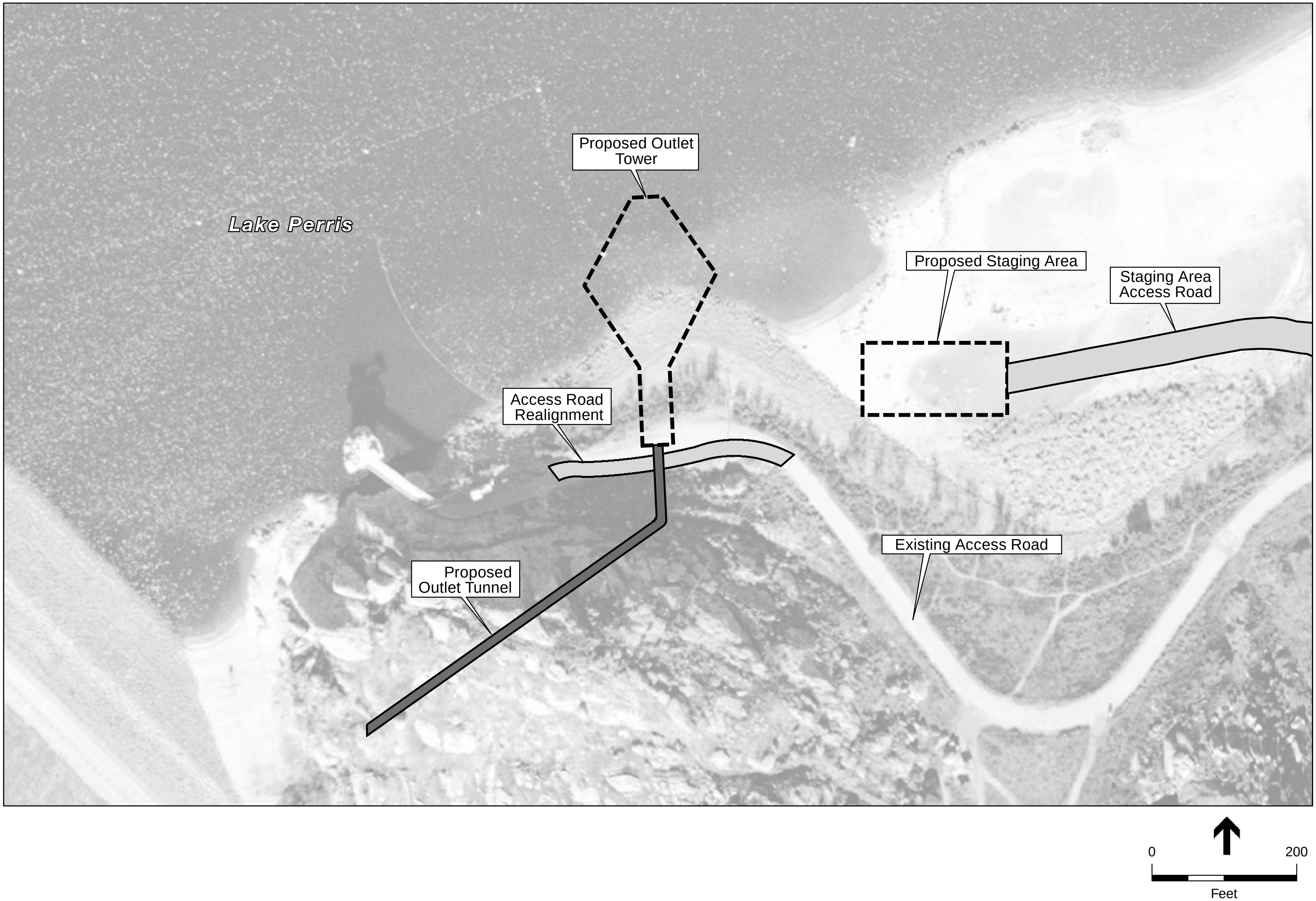

Approximate Exclusion Zone

0 3,500
Feet

SOURCE: GlobeXplorer, 2007; DWR, 2007; ESA, 2009.

DWR - Perris Dam Remediation Program . 206008.02

**Figure 2-9**
Approximate Exclusion Zone
Off limits to Public
During Construction




SOURCE: GlobeXplorer, 2007; DWR, 2007; ESA, 2009.

DWR - Perris Dam Remediation Program . 206008.02

**Figure 2-10**
Proposed Outlet Tower
New Structure Location Plan

## 2.5.4 Emergency Outlet Extension

DWR is proposing to modify the existing valve and control systems to reduce emergency releases to a maximum 1500 cfs. DWR would also construct a new emergency outlet extension in the form of a conveyance that would completely contain and convey the maximum release from the dam to the Perris Valley Storm Drain. Figure 2-7 identifies the proposed route of the emergency outlet extension.

The proposed outlet extension would be approximately two miles long with a 1500 cfs capacity to the Perris Valley Storm Drain. There are two alternatives for the outlet extension being addressed. The first alternative would be underground as either a box culvert or pipeline from the existing outlet structure to Lake Perris Drive. The remaining portion of the conveyance channel from Lake Perris Drive to the Perris Valley Storm Drain, would either continue as an underground conveyance or transition to an unlined, open trapezoidal channel. This segment would be approximately 2700-feet long and would parallel Ramona Expressway and terminate at the Perris Valley Storm Drain. A 20-foot wide service road would run parallel to the conveyance channel. The maximum total affected width along the underground segment would be 110-feet. The maximum total affected width for the open channel option would be 160-feet including the service road. At the conjoining of the emergency outlet extension and the Perris Valley Storm Drain, a velocity dissipater structure would be constructed as a below-grade concrete vault.

The second alternative would be an unlined, open trapezoidal channel for the entire length of the outlet extension. A 20-foot wide service road would run parallel to the conveyance channel. The maximum total affected width for the open channel would be 160-feet including the service road. At the conjoining of the emergency outlet extension and the Perris Valley Storm Drain, a velocity dissipater structure would be constructed as a below-grade concrete vault.

The alignment crosses MWD's buried 10-foot diameter pipe just southwest of the existing outlet structure. The conveyance would cross over MWD's pipeline at this location. The underground conveyance alternative would be approximately six feet higher than the surrounding ground level, creating a small hill covered with soil. The open conveyance alternative would require approximately 300 feet of canal to be lined with concrete to prevent erosion near the pipeline. The length of the concrete is due to the skew orientation of the canal and pipeline alignments.

The alignment crosses three roads which run perpendicular to Ramona Expressway: Fair Way, Lake Perris Drive, and Evans Road. These roads would experience lane closures during the construction of the emergency outlet extension, but no full road closures would be necessary. Each road crossing would be restored after construction and would pass over the underground conveyance. If the segment between Lake Perris Drive to the Perris Valley Storm Drain is to be a trapezoidal open channel, then reinforced concrete box culverts would be placed at the Evans Road crossing. A reinforced concrete box culvert would also be used to pass flow into the Perris Valley Storm Drain. Riprap would be placed on the upstream and downstream slopes of the Perris Valley Storm Drain to reduce localized scour.

### 2.5.5 Perris Lake Refilling

Once construction of each project component is complete, the lake would be refilled to its original elevation of 1588 amsl. The lake would be filled by SWP water when available for delivery. The refilling would require approximately six months, assuming water availability over a consistent period.

## 2.6 Construction Characteristics

### 2.6.1 Construction Schedule

**Table 2-1** summarizes proposed construction activities for each project component and estimated durations for those activities. As shown in the table, each of the three main facilities included in the project would require approximately two years each to construct. If the project components are constructed sequentially, the total construction period would be approximately four years to be completed in 2014. If the project components are constructed simultaneously the total construction period may be less than four years.

**TABLE 2-1**
**CONSTRUCTION DURATION**

| | Duration (months) | | |
|---|---|---|---|
| **Construction Activity** | **Dam Remediation** | **Outlet Tower Replacement** | **Emergency Outlet Extension** |
| Preliminary Activities and Site Preparation | 2 | 2 | 2 |
| Relocate Utilities | - | - | 6 |
| Excavation | 4 | 3 | 2 |
| Blasting | 7 | 1 | - |
| CDSM Treatment | 15 | - | - |
| Structure Improvements | 6.5 | 3 | 5 |
| Embankment Fill and Additional Improvements | 8.5 | - | - |
| Construct Outlet Release Extension | - | - | 3 |
| Construct Conveyance | - | - | 6 |
| Construct Delivery Tunnel | - | 3 | - |
| Construct Outlet Tower | - | 8 | - |
| Site Restoration and Demobilization | 3 | 2 | 3 |
| **Total Construction Duration Per Component** | **22** | **18** | **22** |

SOURCE: DWR

**Table 2-2** highlights a proposed construction sequence and the required equipment for each component. In general, construction activities, except for installation of CDSM elements, would occur between 7:00 a.m. and 7:00 p.m., five days per week (Monday through Friday). Weekend and nighttime work may be required during some periods of construction activity. CDSM activities for the dam remediation component would be limited to two 10-hour shifts per day,

**TABLE 2-2**
**CONSTRUCTION SEQUENCE AND EQUIPMENT**

| | Proposed Construction Sequence | Required Equipment |
|---|---|---|
| Dam Remediation | • Mobilize<br>• Delineate and fence equipment and work areas<br>• Grade buttress area below dam<br>• Grade/blast new haul road<br>• Clear embankment, borrow , and stockpile/staging areas<br>• Blasting at quarry<br>• Excavate borrow area<br>• Excavate below dam<br>• Cement deep soil mixing<br>• Haul soil and rock to toe of dam<br>• Construct and compact stability berm | Excavators and/or Scrapers, Graders, Loaders, Bulldozers, CDSM rigs, Vibrating rollers, Sheepfoot rollers, Hydraulic backhoes, End-dumps and belly-dumps, Dump trucks, Large trucks (importing material and cement to the site), Generators, Drill rigs, Water trucks, Tractor and disks, Asphalt concrete paver, Tandem roller, Pneumatic roller, Rock crusher, Shaker, and Conveyor belts, Air-track drill, Diesel generator unit (attached to mixing rig), Cement pump, Water tanks, Water pumps, Cement grout mixer, Cement silos, Control room, Multipurpose generator |
| Outlet Tower | • Mobilize and clear staging area<br>• Excavate (blasting)<br>• Construct new outlet tower<br>• Tunnel to existing outlet tunnel<br>• Remove granite plug (underwater blasting), joining new tower to lake | Bulldozers, Graders, Scrapers, Water trucks, Concrete trucks, Excavator, Dump trucks, Personal vehicles, Large trucks (importing material and cement to the site), Generators, Jumbo air drill, Rubber tire mucker |
| Emergency Outlet Extension | • Mobilize<br>• Clear and grub project area<br>• Identify and remove or relocate existing buried utilities<br>• Excavate conveyance trench<br>• Place/construct conveyance pipe/box culvert<br>• Compact backfill around conveyance<br>• Tie-in to Perris Valley Storm Drain | Bulldozers, Graders, Scrapers, Sheepfoot rollers, Water trucks, Concrete trucks, Excavators, Dump trucks, Lumber truck, Forklift, Asphalt paver, Tandem roller, Crane, Pneum roller, Personal vehicles |

SOURCE: DWR

Monday through Saturday with no work conducted between midnight and 4:00 a.m. Large haul truck trips to and from the site would be generally limited to the hours of 7:00 a.m. to 7:00 p.m., Monday through Friday, although some haul truck trips to and from the site could occur occasionally on weekends. Deliveries from off site would include cement, concrete, reinforcing steel, fencing, pipe, asphalt concrete, other construction materials, and construction equipment.

Continued use of trails and other recreation activities would be allowed during most of the proposed project construction period in areas sufficiently distant from the construction activities to ensure public safety. Construction zones would be clearly demarcated, controlled, and patrolled. Site access and control would be coordinated with Lake Perris SRA staff. Activities such as camping, picnicking, swimming, boating, rock-climbing, hiking and fishing would be temporarily closed at the Bernasconi Picnic area during construction.

## 2.6.2 Truck and Worker Commute Trips

On an average work day, construction traffic to the site would average 37 round-trips by trucks and 60 round-trips by personal vehicles. Peak construction traffic would depend on the number of activities performed concurrently and the length of time construction materials would be delivered to the site. The assumed daily maximum construction traffic for the proposed project would occur under a scenario in which CDSM treatment, outlet structure construction, and emergency outlet extension construction take place concurrently. Under such a scenario, peak daily vehicle trips would include about 1520 one-way trips, consisting of 1250 one-way trips by trucks and 270 one-way trips by personal vehicles (**Table 2-3**). An estimated 375 one-way daily truck trips, which represent 30 percent of all daily truck trips generated by project activities, would be external trips to and from the site. It is estimated that the remaining 70 percent (approximately 875 one-way daily truck trips) of all truck activity would remain on-site (borrow area, rock quarry, haul road, etc.) for the duration of the project.

**TABLE 2-3**
**ESTIMATED PEAK PERSONAL VEHICLE TRIPS**

| Construction Activity | Number of Personal Vehicle Trips |
|---|---|
| Dam Remediation | 65 |
| Outlet Tower Replacement | 25 |
| Emergency Outlet Extension | 45 |
| **Total Daily Personal Trips** | **135** |
| **Total Daily One-Way Personal Trips** | **270** |

SOURCE: DWR

## 2.6.3 Construction Activities

### Dam Remediation

The fill material required for construction of the berm would total approximately 1,680,000 cy. The CDSM operation would mix approximately 80,000 cy of soil and cement for use as deep foundation material. The drainage blanket of the dam would require approximately 750,000 ton of rocks of varying sizes (six-inch maximum). This rock would be provided by drilling/blasting which would occur on a 13-acre area along the bottom of the existing quarry, located east of the lake within the Bernasconi Hills. **Table 2-4** summarizes daily truck trips required for the dam remediation. The borrow soil and crushed rock truck trips would occur entirely within the construction zone boundaries and would not affect local roadway network.

### Outlet Tower Replacement

The new outlet tower would be constructed approximately 400 feet east of the existing outlet tower. The construction would be done in two phases. Phase I would involve an initial excavation up to a depth of 100 feet to make room for construction of the new facility, including the proposed new outlet structure and the 600-feet long tunnel. Excavation would require blasting,

**TABLE 2-4**
**ESTIMATED PEAK TRUCK TRIPS – DAM REMEDIATION**

| | Soil from Borrow Area | Crushed Rock from Quarry | Cement for CDSM | Other Deliveries | Total |
|---|---|---|---|---|---|
| Total Quantity | 1.68 million cy | 750,000 tons | 13,500 tons | | |
| Quantity per Truckload | 35 tons | 35 tons | 25 tons | | |
| Total Truckloads | 74,520 | 21,430 | 540 | | |
| Delivery Period | 186 work days | 143 work days | 318 work days | | |
| **Truckloads per Day** | **400** | **150** | **1-2** | **20** | **575** |
| **One-Way Truck Trips per Day** | **800** | **300** | **2-4** | **40** | **1,150** |

SOURCE: DWR

shoveling, hauling, and a crew of 15 workers. During Phase I, a rock plug would be created by leaving the front portion without excavation in order to facilitate the construction of the new facility. The top of the plug would be set at elevation 1573, which would provide a freeboard of at least 10 feet above the current lake elevation of 1563.

Phase II would involve the construction of the approach channel by removing the rock plug. It is anticipated that it would be possible to remove the plug by underwater blasting and excavation without further lowering the lake.

It has been estimated that 4300 cy of concrete would be required for the construction of the proposed outlet tower and 30,000 cy of materials would be excavated and hauled. The excess material would be used for the dam remediation component of the project. **Table 2-5** summarizes truck trips required for the outlet tower replacement.

**TABLE 2-5**
**ESTIMATED PEAK TRUCK TRIPS – OUTLET TOWER REPLACEMENT**

| | Concrete | Excavated Material | Rebar | Other Deliveries | Total |
|---|---|---|---|---|---|
| Total Quantity | 8,000 tons | 30,000 cy | 800 tons | - | - |
| Quantity per Truckload | 16 tons | 20 tons | 20 tons | | - |
| Total Truckloads | 403 | 1200 | 40 | | - |
| Delivery Period | 132 work days | 66 work days | 88 work days | | - |
| **Truckloads per Day** | **3** | **18** | **1** | **6** | **20** |
| **One-Way Truck Trips per Day** | **3** | **18** | **1** | **12** | **40** |

SOURCE: DWR

## Emergency Outlet Extension

Approximately 41,200 ft of precast concrete box culverts (or 8000 ft for the pipeline) would be imported for construction of the underground conveyance up to Lake Perris Drive. Culvert sections (or pipeline) would be hauled to the site on flatbed trucks. Approximately 360,000 cy of soil would have to be hauled between the excavation to a stockpile near the dam, 40,000 cy of which would be hauled from the stockpile back to the conveyance for backfill. Thirty-five acres would be cleared along the emergency outlet extension route, topsoil would be replaced after construction completion. **Table 2-6** summarizes truck trips required for the emergency outlet extension (quantities used are for the larger of the two alternative options).

**TABLE 2-6**
**ESTIMATED PEAK TRUCK TRIPS – EMERGENCY OUTLET EXTENSION**

| | Precast Concrete Culvert | Soil from Excavation to Spoil | Other Deliveries | Total |
|---|---|---|---|---|
| Total Quantity | 41,200 ft | 360,000 cy | | - |
| Quantity per Truckload | 16 ft | 34 cy | | - |
| Total Truckloads | 2,575 | 10,600 | | - |
| Delivery Period | 150 | 30 | | - |
| **Truckloads per Day** | **17** | **350** | **5** | **370** |
| **One-Way Truck Trips per Day** | **34** | **700** | **10** | **750** |

SOURCE: DWR

## Description of Construction Activities

The following construction activities are required for each of the proposed project components.

### *Preliminary Activities*

#### Installation of Fencing and Work Area Delineation

Prior to the start of construction activities, all project work areas would be defined to provide site security and public protection. Fencing would be installed to restrict the public from work areas. In addition, a construction office would be established near the construction area.

#### Site Preparation and Haul Road Construction

Construction zones would be cleared and grubbed of vegetation, debris, and large rocks using scrapers and other ground clearing equipment. The project would clear over 260 acres, 135 acres of which would be within the lakebed below the original water level.

A 13-acre, 40-foot wide haul road would be constructed from the borrow area to the dam toe. There would be an approximate three-acre area of assumed disturbance adjacent to the haul road (windrow, minor cut/fill, etc.). A rock quarry access road would be constructed in order to connect the rock quarry to the main haul road (Figure 2-3). This road would disturb approximately two acres.

#### Staging and Stockpiling Activities

A shared 21-acre staging area located downstream of the dam, near the left abutment, would serve, in part, to stockpile materials during the construction of the emergency outlet extension and the dam remediation (see Figure 2-7). A staging area located east of the proposed outlet tower would encompass approximately four acres and a temporary stockpile area would encompass approximately six acres. Stockpiles, which would typically be approximately 10 feet high, would incorporate storm water erosion control features.

Uses and activities within the staging area could include, but are not limited to:

- Stockpiling
- Delivery of construction equipment, cement, drainage rock, and concrete. Equipment would likely be coming and going throughout the construction process. Cement import would end after CDSM activities are complete. Concrete delivery would occur during the extension of the portal walls.
- Delivery of fuel and fueling/maintenance of construction equipment (daily)
- Construction administration and meetings (project trailer) (daily)
- Worker restrooms
- Visitor parking and sign-in area
- Temporary storage for other equipment and materials (concrete forms, scaffolding, etc.) (daily)

### *Excavation Activities*

#### Borrow Area Excavation

The proposed project includes excavation of fill material from a borrow area on the northeastern and possibly the southern portion of the lake, and transport of the material to the work area below the dam. This borrow area is currently exposed, but once the lake returns to its normal operating elevation, the area would be submerged.

As material is excavated from the borrow area, scrapers or haul trucks and other equipment would be used to move the material to the staging and stockpiling area via the haul road. Borrow area excavation activities could involve daily access by fuel and maintenance vehicles. Fuel trucks must maintain a 100-foot distance from the lake water’s edge and maintenance involving hydrocarbons would not be allowed near the lake.

#### Dam Berm Foundation Excavation

Approximately 700,000 cubic yards of soil would be removed from the berm foundation excavation at the toe of the dam. The soil would be stockpiled on site and recompacted in the berm foundation excavation underlying the stability berm. Steel shoring may be needed to secure the side-walls and assist with construction dewatering. These sheet piles would be installed with a pile driver.

## *Blasting*

### Quarry, Haul Road, and Outlet Tower Blasting

Hard rock excavation would be required within the existing quarry, along the haul route over the Bernasconi Hills, and at the shore of the lake for the new outlet tower. In preparation for blasting, drilling would be performed by air-track or jumbo air drills in order to make holes in the rock. For a quarry operation, holes are typically spaced in a grid pattern on 10-foot centers and the depth is approximately 10 to 20 feet. For tunnel work, holes are typically spaced in a grid pattern using two to four foot centers and depths are typically four to eight feet.

Charges would be placed in the drilled holes to fracture the rock. Typically, blasting would be limited to three or four times per day. Blasting would occur in each location periodically. Excavated rock material would be used within the stability berm.

### Underwater Blasting/Excavation

Once the outlet tower excavation is complete and the facility is constructed, the rock plug would be removed. This would require conducting underwater excavation, including blasting.

## *Cement-Deep-Soil-Mixing Activities*

CDSM would be conducted with mixing blades mounted on drill rigs to maintain continuous installation of vertical soil-cement mixed columns. As the mixing shafts are advanced into the soil, a grout mixture of Portland cement and water is pumped through the hollow stem of the shafts and injected into the soil at the shaft tips. Mixing blades on the shafts blend the soil with the grout. When the design depth is reached, the mixing shafts are withdrawn and the mixing process continues until the shafts are completely removed from the ground. After withdrawal, two to six overlapping soil-cement columns remain in the ground.

Cement grout would be batched at the site in a portable cement grout batch plant and then pumped to the mixing rig, which would be approximately 70 to 80 feet tall. Cement would be temporarily stored in silos, which would be about 20 to 30 feet high. Silos would be recharged with regular cement truck deliveries. The grout plant and silos would likely be moved two or three times over the duration of the project to minimize the distance between the cement grout batch plant and the mixing rig. A total of approximately 80,000 cy of soil-cement would be placed by the CDSM method, which would require up to 150,000 gallons of water.

CDSM may also be used to construct a permanent 50-ft deep partial cutoff wall at the downstream toe of the existing dam instead of using sheet piles. This wall would allow the extensive drainage blanket to continue to collect seepage water and relieve pore fluid pressures beneath the dam, while making the groundwater dewatering much more efficient in the excavation area. Reinforcing bars or small beams may be placed into the uncured soil-cement to strengthen the columns.

### Tunneling

Tunneling would be required to connect the new outlet tower with the existing outlet tunnel. The tunnel would be approximately 12.5 feet in diameter and 600 feet in length. Tunneling work involving explosives, mucking, and hauling would take place more than 150 feet below the hill. The excavated material, mostly hard rock, would be used in the dam remediation component, or would be stockpiled.

### Compaction Activities

Compaction of the berm and backfill materials would be accomplished with a tamping-type roller capable of obtaining required densities within allowable moisture contents. The material would be obtained directly from the borrow areas or double-handled from stock piles. Prior to placement, the material would be sufficiently mixed and moisture conditioned, either in the borrow areas or on the stock piles, using disking equipment, a motor grader, and water trucks, if necessary. The material would be placed in uniform, horizontal layers. The edges would likely be overbuilt and trimmed back to final grade.

### Underground Conveyance

An open trench would be excavated approximately 70 feet wide and 15 feet deep. The trench would be sloped to avoid the need for shoring. The bottom of the trench would be prepared with appropriate bed material. Precast concrete pipe or box-culvert sections would be transported to the site and lowered into the trench using a crane. The sections would be connected, and the conveyance buried. The initial 2000 feet of the Emergency Outlet Extension would be installed through cut and cover construction methods. If the precast concrete pipe is the chosen alternative, the section described above would continue 6200 feet to Lake Perris Drive. If box-culverts are used, an open trench would be excavated approximately 110 feet wide and 10 feet deep along the 6200 foot segment. The box culverts would be placed in the trench and backfilled. Excess soil would be used within the stability berm.

### Open Channel Construction

Either the entire channel or the final 2700 feet of the Emergency Outlet Extension would be installed as open trenching methods. An open trench 160 feet wide and approximately 15 feet deep would be excavated. A scraper operation would excavate the material from the channel to a stockpile area near the dam. Graders would fine grade the slopes and topsoil would be placed on the invert and side slopes. A natural mix of seed would be applied to the slopes and invert of the finished channel.

## 2.7 Discretionary Approvals Required for the Project

**Table 2-7** on the following page presents a preliminary list of the agencies and entities in addition to DWR that would use this EIR in their consideration of specific permits and other discretionary approvals that may apply to the project. This EIR is intended to provide these agencies with information to support their decision-making processes. The table also lists the types of activities that would be subject to these requirements.

**TABLE 2-7**
**DISCRETIONARY PERMITS POTENTIALLY REQUIRED**

| Agency | Permits and Authorizations Required | Activities Subject to Regulations |
|---|---|---|
| U.S. Army Corps of Engineers | Clean Water Act Section 404 Permit | Placement of dredge or fill materials into waters of the U.S. |
| California Department of Fish and Game | 1602 Lake and Streambed Alteration Agreement | Fish and Game Code Section 1602 applies to projects impacting perennial, intermittent, and ephemeral rivers, streams, and lakes in the state. |
| Regional Water Quality Control Board | Section 401 Water Quality Certification | Placement of dredge or fill materials into waters of the state. |
| | Storm Water Pollution Prevention Plan | Control of runoff from construction sites. |
| Riverside County | Multiple Species Habitat Conservation Plan (MSHCP) Approval | Activities within known habitat or designated critical habitat for a federal threatened or endangered species. Activities that could result in potential “take” of a listed species. |
| Riverside County Flood Control and Water Conservation District | Encroachment permit | Connection with Perris Valley Storm Drain |
| City of Perris | Local Encroachment Permits | Construction access within City of Perris roadways. |